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# (12) United States Patent Usui et al.

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## (54) HIGH-PRESSURE FUEL PUMP ASSEMBLY MECHANISM

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#### (56) References Cited

#### U.S. PATENT DOCUMENTS

4,986,728 A \* 1/1991 Fuchs ....... F02M 59/30 123/506 5,685,519 A 11/1997 Bircann et al. (Continued)

#### FOREIGN PATENT DOCUMENTS

DE 10322599 A1 \* 12/2004 ...... F02M 59/102 DE 103 44 459 A1 4/2005 (Continued)

### OTHER PUBLICATIONS

Japanese Office Action dated Aug. 28, 2012 (three (3) pages). (Continued)

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#### (57) ABSTRACT

A high-pressure fuel pump includes a pump housing formed with a recess, a cylinder combined with the pump housing to define the recess as a pressurizing chamber, a holder securing the cylinder to the pump housing, and a plunger sliding against the cylinder to pressurize fluid in the pressurizing chamber. The holder includes an outer cylindrical surface portion fitted to an attachment fitting hole of an engine block of an internal combustion engine, and a cylindrical fitting portion fitted to an outer circumference of the cylinder. The outer cylindrical surface portion and the cylindrical fitting portion are formed in a single piece resulting from machining one and the same member.

#### 19 Claims, 12 Drawing Sheets

